General Comments on the Overall Approach

We concur with CALFED employing an adaptive management approach, utilizing monitoring, focused research, and ecological indicators, to develop and implement the ERPP. While we agree with the discussions in the ERPP regarding adaptive management, we want to add to these constructive ideas to promote a common understanding of what adaptive management means. Adaptive management is when existing conditions are leading to a decline of fish and wildlife resources, actions are implemented, monitored and evaluated that are intended to provide a substantial improvement in fish and wildlife and their habitats in order to expect a measurable change. It is a scientific process requiring implementation of dramatic experiments, including predictive models, evaluating them, and adapting to increased scientific understanding (Van Winkle, et al. July, 1997, Fisheries, Vol. 22, No. 7). We are concerned that a modeling component, conceptual and mathematically based, is practically nonexistent in the plan. The plan also lacks, at least explicitly, a strong conceptual scientific framework based on testable hypotheses. The scientific conceptual framework and the modeling component must be greatly enhanced and clearly stated in the plan.

A strong conceptual framework based on testable scientific hypotheses is an essential element of any ecosystem management program, especially on the scale of the CALFED program (Slocombe 1993, Bioscience 43: 612-622; Grumbine 1994, Conservation Biology 8: 27-38; Christensen et al. 1996, Ecological Applications 6: 655-691). The adaptive management process requires testable hypotheses (Walters and Holling 1990, Ecology 71:2060-2068; Christensen et al 1996). ERPP goals, objectives, and implementation strategies must be scientifically based and defensible. While we believe that the ERPP has an implicit scientific basis, this basis needs strengthening and to be explicitly stated. The Service recommends developing and stating testable scientific hypotheses and conceptual models of ecosystem function as a basis for formulating and explaining ERPP goals, objectives, and implementation strategies. Conceptual models and testable hypotheses provide a framework to direct the adaptive management process, to develop implementation strategies, to identify scientific needs and approaches (modeling, monitoring, focused research), and to identify ecological endpoints, success criteria, and indicators. In addition to guiding scientific and management activities, conceptual models can be used to explain and justify ecosystem restoration strategies to non-technical audiences (e.g., policy makers, stakeholders, general public). Conceptual modeling is a proven effective tool for large-scale ecosystem restoration and protection planning (e.g., south Florida, Chesapeake).

Modeling, including descriptive conceptual and predictive mathematically based models, is an integral component of ecosystem management and the adaptive management process (Holling 1978; Walters 1986; Christensen et al. 1996). The value of conceptual modeling is discussed above. Modeling, monitoring, and focused research are essential elements of the scientific approach to ecosystem management. Volume III needs a section on predictive ecological and hydrological (and other necessary physical processes

models) modeling, similar to the monitoring and focus research sections. This section should discuss the need, value, and application of the modeling component. It should discuss the modeling needs to successfully implement and evaluate the ERPP, including landscape-level, population-level, ecological processes models (e.g., trophic dynamics, nutrient dynamics), hydrological and hydrodynamic models, and water quality models. This discussion should include the efficacy of applying existing models and describe a process for developing new models if needed. The section should integrate ERPP modeling needs with those of the other CALFED programs and activities, especially water quality and water conveyance and storage.

We also recommend incorporating the ecological and environmental aspects of the Water Quality Program Plan into the ERPP. The ERPP does a good job explaining the commonalities and need for integration between the two programs. However, transferring the ecological component of the Water Quality Program into ERPP is the most effective and comprehensive approach to ecosystem management, restoration, and protection.

CALFED should consider establishing a scientific advisory group and a scientific oversight panel, similar to that convened for review of the ERPP, to guide the scientific approach for the ERPP (and ecological components of Water Quality Program) throughout the programs' existence. The advisory group would be composed of scientists with "local" expertise covering all required disciplines and the geographic and ecological scopes of the CALFED problem and solution areas. This group should have scientists from the CALFED agencies and must have scientists from outside the CALFED agencies, such as from academic institutions and stakeholder organizations. The scientific oversight panel would be an independent review panel of nationally recognized experts in ecosystem management who do not directly work in the CALFED area, similar to the current ERPP Review Panel. The ERPP outlines a similar mechanism for the scientific and adaptive management processes (e.g., pp. 17, 44-45).

The document states that the ERPP will take a holistic ecosystem approach to environmental management; however, in several cases the approach to implementation strategies seems focused on certain species. For example, in several cases where strategies for aquatic habitats and species are discussed it is explicitly stated or implied that these strategies are for fishes, without mention of or apparent consideration for other aquatic species and habitats and processes related to them. The strategy discussed for setting implementation priorities is conflicting and confusing. On page 27, ecosystem elements are ranked in priority as ecological processes, habitats, and species, which is the appropriate ranking using a holistic ecosystem approach. However, in the section "Basis for Setting 5-year Implementation Priorities" (pages 29-31) priorities and ranking are strictly by species, and almost entirely fishes. The ERPP must resolve and explain these seemingly conflicting approaches to environmental management.

Specific Comments

Introduction

The overview/introduction section should present a brief objective analysis and discussion of ecological issues and problems in the Study Area, including relating stressors to these issues and problems. This section should also briefly discuss the conceptual framework and goals, objectives, and purposes of the ERPP. A figure(s) containing a simplified conceptual model would be useful here. It should also briefly discuss potential conflicting objectives and trade-offs of the overall CALFED program and within the ERPP. These topics should be discussed in detail in the introductory section of Volume I of the ERPP.

Geographic Scope, Pages 3- 4. It is essential for CALFED to identify the ecological linkages between the Delta ecological zone and the other ecological zones to maximize benefits of ERPP actions and minimize adverse ecological impacts of CALFED actions. For example, wading birds and waterfowl utilizing the Delta also use other ecological zones. Freshwater flow through the Delta affects water quality and thus water column and benthic biotic communities in San Pablo Bay, and north, central, and south San Francisco Bay (Nichols et al 1986, Science 231: 567-573). Actions to increase sediment and nutrient supply to the Delta may have adverse ecological impacts farther downstream. Therefore, CALFED must consider more than just fish and riparian/riverine habitat in ecological zones outside the Delta.

Implementation Strategy,Page 4, first paragraph. Because ecosystem health is the goal of the ERPP, the entire process is weakened by the lack of specificity of the term. Define what is meant by ecosystem health and provide a list of factors that contribute to it.

Page 5. The implementation strategy must include a modeling component (see general comments above). Please add a paragraph describing the value and rationale for modeling as is done for monitoring and focused research.

Page 5, paragraph on indicators. The document states that indicators are features expected to change in response to ERPP actions. However, CALFED should consider that additional indicators may be necessary to track stability of certain ecological processes, habitats, or species. That is, there may be some factors that you do not want to have change. The only way to track the status of these factors is to establish indicators for them as well. Include such factors in the adaptive management plans or explain why they are not necessary. These factors can be identified using conceptual modeling based on testable hypotheses.

Refinement and Implementation, Page 5, Refine. The ERPP is based on "broad public participation" and uses "the best scientific knowledge currently available." The needs or desires of the public may at times conflict with scientific knowledge or recommendations grounded in science. Please discuss how such conflicts will be resolved.

Page 5, Conduct immediate focus research. This is important; we concur. Of equal importance is to apply and refine existing ecological and physical models, and develop new needed models, to improve understanding of the ecosystem and to identify environmental problems and their causes.

Terms Used in ERPP, Page 6, Species and Species Groups. Include a fourth, and very important, criterion: It is important in maintaining ecosystem function and structure (e.g., keystone species). The ERPP is an "integrated ecosystem approach", not "individual species management."

Page 6, Stressors. It is important to distinguish between anthropogenic disturbances (stressors) to ecosystems and natural disturbances. We recommend using the term "stressor" only for human disturbance.

Adaptive Management

The ERPP must consider and incorporate the role of natural variability and natural disturbance in the adaptive management process. Both factors affect ecological responses to management actions, and thus the evaluation and adaptation of management actions. It is important to distinguish the effects of natural disturbance from anthropogenic stressors on ecosystem structure and function. This topic should be discussed in the adaptive management and ecosystem indicators sections.

The text and flow charts provide a good explanation of applying adaptive management at the programmatic level, to set targets, and develop implementation strategies. It would be useful to give an example of adaptive management applied to implementation actions for specific ecosystem elements.

Introduction, Page 8, first paragraph. State that this definition of ecosystem management is the one that will be used for the purposes of the CALFED ERPP.

Page 9, Vision, first sentence. The current wording sounds like the function of the CALFED ERPP program is exclusively to encourage the participation of others. Clarify the role of the program in implementing ERPP actions.

Page 10, Uncertainty. Uncertainty should not be confused with inherent variability. For example, variation in rainfall may influence the population size of an annual plant. Population size in a drought year may be small, but this may not be cause for a change in

program actions. The adaptive management strategy of the ERPP needs to consider the natural range of variation. Include a better discussion of the natural range of variation as it relates to adaptive management.

Potential Drawbacks of Adaptive Management, Page 15. The document states that a phased approach may delay implementation and could allow declines in the health of important ecosystem components. It is imperative that CALFED prioritize actions in a manner that avoids any declines in the health of ecosystems (*i.e.*, components that are at risk of decline should be placed as a high priority). A predictive modeling component may assist in determining the components at risk of decline and placing them as a high priority.

Page 11, Potential Drawbacks of Adaptive Management. The summary statement indicates that the potential benefits ...outweigh any drawbacks. We recommend that potential benefits be listed in a bullet format similar to the potential drawbacks, so the reader can easily refer to and compare them.

Page 11, third bullet in the section. Because there may be a long lag time before benefits are detectable, program elements should be dropped with caution. Individual program elements and benefits may not have a clearly significant impact, a large regional impact, or even be detectable with monitoring, but the combined effects of several programs hopefully will be significant and detectable. Detailed research may be needed to assess individual program elements. Note this in your discussion. As discussed on page 13, conduct predictive modeling and careful monitoring so that benefits are either tracked or assumed rather than dismissed as "undetectable" and the element is dropped.

Application of Adaptive Management to the Ecosystem Restoration Plan, Page 11, right hand column, second paragraph. Replace the word "theories" with "hypotheses."

Page 12, second full paragraph on the page. This paragraph emphasizes fish and wildlife species. Include processes important to plants.

Requirements of the Adaptive Ecosystem Management Program, Page 12, introductory paragraph. Monitoring programs generally are not designed to test hypotheses, although they may identify a hypotheses to test. Specific research must be designed to test a hypothesis. Change: "development and implementation of monitoring programs to test hypotheses" to "development and implementation of science programs (including research, modeling, and monitoring) to test hypotheses."

Page 13, Priorities. The paragraph discusses establishment of priorities. Indicate who identifies and prioritizes critical needs. Indicate what factors will be considered when decisions about priorities are made.

Assurances, Page 14, first paragraph. Add: "The intent is for all of the elements of the CALFED program to have equal levels of assurances."

Page 15. Implementation of HCP/ERPP should not allow declines in the health of important ecosystem components, particularly threatened and endangered species. The assurances section of the HCP/ERPP should have a contingency plan for species with declining populations or species that lack sufficient current population data. If species become more endangered over time, this will allow protection needs to be accommodated by the program.

Proposed Adaptive Management Process Framework, Page 15. Include modeling with focused research and monitoring as part of the adaptive management process.

Page 17, first paragraph. "the annual develop of 5 year plans" does this mean that 5 year plans will be annually evaluated and revised if necessary?

Page 17. The management oversight and technical groups should have lead responsibility for developing project success criteria, with input and review by the stakeholder group and scientific review panel. The stakeholder group should not be the lead for this task.

Page 19, Strategies. The ERPP must include a strategy to establish and maintain preferred salinity patterns; therefore, salinity patterns should be listed here. Salinity patterns should be an ecosystem processes element.

A strategy to establish and maintain preferred hydrologic and hydrodynamic patterns is an essential part of the ERPP; thus, this strategy should also be listed here. This overarching ecosystem attribute includes several of the ecological process elements and affects most of the habitat elements.

Strategies for Phased Implementation

The discussion on establishing implementation priorities is conflicting and confusing. The document states that the ERPP will take a holistic ecosystem approach to environmental management (page 2). Following this approach, ecosystem elements are ranked in priority as ecological processes, habitats, and species (page 27). However, in the section "Basis for Setting 5-year Implementation Priorities" (pages 29-31) priorities and ranking are strictly by species, and almost entirely fishes. Also, the priority strategy for "Species" (page 28) does not include ecological functional importance. Those species important in maintaining ecosystem structure and function (e.g., keystone species) should be identified and given high priority. CALFED must resolve and explain these seemingly conflicting approaches to environmental management.

Page 23, Implementation Strategies. The ERPP must include a strategy to establish and maintain preferred salinity patterns; therefore, salinity patterns should be listed here. Salinity patterns should be an ecosystem processes element.

A strategy to establish and maintain preferred hydrologic and hydrodynamic patterns is an essential part of the ERPP; thus, this strategy should be presented here. This overarching ecosystem attribute includes several of the ecological process elements and affects most of the habitat elements.

Page 23, Cumulative Benefits. The cumulative benefits discussion acknowledges implementation of other restoration programs, such as the Anadromous Fish Restoration Program (AFRP). It should also include the Recovery Plan for the Sacramento/San Joaquin Delta Native Fishes.

Page 24, Strategy for Land Acquisition and Conversion to Habitat. This section identifies the need for development of conservation easements or the direct acquisition of lands from willing sellers. Also, discuss the process for developing and implementing habitat conversion plans.

Page 24, Strategy for Land Acquisition and Conversion to Habitat. Agricultural lands are listed under "Land under consideration must be suitable for conversion to at least one of the following uses" without additional explanation. Please provide a rationale for why creating agricultural land is an ERPP objective.

Page 24, Strategy for Land Acquisition and Conversion to Habitat. The rationale for limiting land acquisition for conversion to habitat to the delta is unclear. Opportunities may exist in the Sacramento and San Joaquin valleys as well, particularly in areas proposed for floodways and meander belts. This section should be clarified and further evaluation given to land acquisition for conversion to habitat upstream of the Delta.

Page 25, Strategy for Contaminants. The ERPP strategy "to assist" is too vague; a more detailed description is needed. Ecological contaminant implementation strategies and proposed actions stated in the Water Quality Program Plan should be incorporated into the ERPP or at the very least the linkages between the two plans should be significantly strengthened.

Page 25, Strategy for Control of Invasive Organisms. The strategy "to support" is too vague; more detail is needed.

Page 28, Species, first paragraph. It is unclear what is meant by the statement that "Species restoration measures will be the result of a three-step process..." Does this mean that actions taken in the restoration of individual species will be based on three factors, and that the three factors are ecosystem quality, habitat quality, and threat identification? Please clarify.

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Page 28, Species, second paragraph. Species priorities should also be based on ecological functional importance. Those species important in maintaining ecosystem structure and function (e.g., keystone species) should be identified and given high priority.

Page 29, Basis for Setting 5-Year Implementation Priorities. All first and second level species are fishes. The Service does not agree that all other aquatic species, all terrestrial species, and all plant species should be ranked third. Provide additional clarification about how the ranking system will be used and additional justification for these ranking choices. We will review the clarification and justification for these ranking choices and provide further comments at that time. In the interim, we recommend that steelhead, spring-run chinook salmon, and splittail be included as first level species and striped bass, American shad, white sturgeon and Sacramento perch be included as second level species. Those species which are listed or being considered for additional protection pursuant to the ESA should be first level. Those species targeted for restoration efforts by either the AFRP or the Recovery Plan for Delta Native Fishes should be included as second level species.

Ecosystem Monitoring (including Appendix 4)

A monitoring subprogram for invasive exotic aquatic plants and animals is needed. Although aspects of exotics are covered under some subprograms, overall exotic species monitoring should be integrated and coordinated under an exotics subprogram.

Monitoring subprograms are needed for all appropriate terrestrial (and aquatic) ecosystem processes, habitats, and biotic assemblages. The Service recognizes that the major focus of CALFED is aquatic ecosystems, but this should not be the only focus.

The ecosystem monitoring program must include monitoring for all appropriate ecological endpoints and indicators. Some of the proposed ERPP endpoints and associated indicators are not covered by the monitoring subprograms presented here.

CALFED correctly implies that an effective restoration program must start with acquiring knowledge that will provide the scientific and technical basis for restoration actions. CALFED should systematically and comprehensively determine the necessary scientific information to develop, implement, and evaluate ecosystem restoration and management strategies; assess current scientific information; and identify scientific information gaps and the activities (monitoring, focus research, modeling) to fill these gaps. We recommend that CALFED consider conducting workshops or meetings with scientific and technical experts for each ecological zone, and perhaps for special topics such as fisheries, listed species, and contaminants, as one means to accomplish these tasks. CALFED should identify and evaluate all scientific activities by all levels of government, academic and scientific institutions, and stakeholder groups. These efforts would identify scientific needs for monitoring, focused research, and modeling.

Page 35-36. The design objectives and approach outlined for Ecosystem Monitoring are generally good. A centralized data repository, that is available to all, should be established. CALFED should develop and implement a strategy for standardizing methods of monitoring and data/sample collection and analysis. It is important that similar type data (e.g., water quality) collected by different entities and/or in different subprograms be comparable.

River and Estuarine Flow Monitoring, Page 36. Integrate flow monitoring with hydrological and hydrodynamic monitoring efforts.

System Wide Basic Water Quality Monitoring, Page 108. Phosphorous and nitrogen (nutrients) are water quality parameters essential for interpreting biological data and explaining ecosystem structure, function, and response to stressors; they must be included in the water quality monitoring program.

Page 110, "3) Integrated Analysis...". This is good. Include also an integrated, centralized Quality Assurance/Quality Control (QA/QC) program.

Page 111, Key Focused Research. Add nutrient and light limitation/threshold research for aquatic plants (phytoplankton, submerged macrophytes). For "3)" modeling should cover monitored and unmonitored areas.

System Wide Aquatic Contaminants Monitoring, Page 111. State the contaminants to be monitored; identify "those most likely to cause adverse biological effects."

Page 112-113, Bioaccumulation Monitoring. Nesting shorebirds are excellent indicators of local selenium exposure while carefully designed research or monitoring can assess contaminant exposure to wintering waterfowl and other birds. Include birds that feed on aquatic organisms (wading birds, waterfowl, pisivorous rapters).

Page 112, Key Focus Research. Include key birds and invertebrates; not just fish. Conduct research to establish relationship between tissue concentration and biological effects, especially sublethal effects, for key species. For "3) Develop and implement biomarkers" add "and bioassays"; bioassays and biomarkers should also be developed for key invertebrates and birds.

Estuary, River Wetland, Riparian Habitat Monitoring, Page 38. The document states that the Central Valley and the Bay-Delta do not have habitat monitoring programs, and that CALFED will encourage other groups to coordinate design and implementation of a program. CALFED should coordinate or assist in developing an integrated comprehensive habitat monitoring program. The document should state how this program would be designed and implemented.

A predictive landscape model is needed to support an adaptive management approach to wetland and riparian habitat restoration and protection. The monitoring program would provide data for the landscape model.

Page 113, #1, and throughout document. The focus for riparian habitat restoration and monitoring seems to be on the shaded riverine aquatic component, not the entire corridor. It is essential the entire corridor be the focus of restoration and monitoring.

Page 113, #3. Wildilfe productivity and abundance should also be included.

Estuary Primary Productivity and Nutrient Monitoring, Page 114, Subprogram Element Description. Add all forms of phosphorous. Add all forms of nitrogen, not just dissolved. Add submerged aquatic vegetation (includes seagrass, macroalgae, other macrophytes) abundance, distribution, and productivity (where present).

Page 115, Key Focus Research. Add seagrass (and maybe macroalgae) light and nutrient limitation/threshold research in San Pablo Bay (similar to work of Dennison in Tomales Bay). San Pablo Bay has the greatest seagrass acreage of any water body in the San Francisco Bay estuarine system.

Estuary Benthos Monitoring, Pages 39, 118. If this subprogram includes only the invertebrate component of the benthos, then change the subprogram name to reflect this. If holistic benthos monitoring is intended, then include submerged aquatic vegetation (SAV: seagrass, macroalgae, other macrophytes). SAV monitoring must be included in the ERPP monitoring program.

Estuarine Fishes Monitoring, Page 120, 6) Estuarine Shallow water Habitat Fish. Include habitat (including SAV) monitoring and assessment in conjunction with fish monitoring.

Monitoring Data Management and Dissemination Subprogram, Page 41. This is good. Data management for the ERPP monitoring and focused research programs and monitoring and research data from the ecological component of the Water Quality Program should be integrated and coordinated, with these data stored in a central repository or database. CALFED data management should be coordinated with data management for San Francisco Bay programs.

Action Specific Monitoring, Page 42, Tidal Wetlands and Shallow Water Habitat. Submerged (seagrass, macroalgae, brackish and freshwater macrophytes) and emergent vegetation should be monitored.

Page 43, Riverine/Riparian Habitat. In addition to the surveys listed for riparian birds and mammals, aspects such as habitat structure, productivity and predation should be included to assess overall suitability for riparian dependent species.

Monitoring Implementation Strategy, Page 44-45. The high-level technical team is a good proposal. A scientifically-driven approach and scientific oversight are essential strategies for ERPP development and implementation.

Indicators of Ecosystem Performance

The proposed ecological endpoints (success criteria, performance targets) and their associated ecological indicators must be developed and presented in a scientifically sound conceptual framework. Levy et al (1996) provides a good initial framework. However, it seems that the ERPP has not built much upon this framework. We are concerned that not all proposed ecological endpoints and indicators have been critically evaluated; many are too general and vague; that there may be too many indicators; that some of the proposed indicators may not give a good indication of ecosystem function, and thus ecosystem restoration performance (i.e., not ecologically relevant); and that the possibility that some indicators may be conflicting has not been fully evaluated. The Service recommends that the ERPP develop habitat or ecological zone based conceptual models to elucidate the relationships between human stressors on the ecosystem, natural disturbance, and ecosystem structure and function (includes processes, habitat, and species elements), and to identify and justify ecological endpoints, indicators, and performance measures. Groups of experts for each habitat or ecological zone (or typology components of Levy et al.) should be utilized to refine the conceptual models, ecological endpoints, and indicators. This approach is particularly valuable for identifying ecological endpoints and indicators for habitat ecosystem elements.

The ecological endpoints and indicators of ecosystem performance for all ecosystem elements (processes, habitats, and species) must be ecologically relevant and scientifically defensible. This implies that they are well-defined and that they accurately measure the intended variable or process. The latter implies that existing data are available to support the relationship between the indicator and the variable or process. For most of the proposed ecological endpoints or success criteria no reference is provided to support its validity. For example, for many species elements indicators, it is not clear that population and distribution data are available for the proposed baseline period. For each ecological endpoint and associated indicator, please include specific criteria, if possible, and a discussion of available data to support its use. Include a literature cited section containing the references upon which the criteria are based and where the supporting data were obtained (e.g., recovery plans for listed species should used and cited).

The ERPP must consider and incorporate the role of natural variability and natural disturbance when using ecological indicators to access ecosystem status and the effectiveness of management actions. Both factors affect ecological responses to management actions, and thus the evaluation and adaptation of management actions. It is important to be able to distinguish the effects of natural disturbance from anthropogenic stressors on ecosystem structure and function. This topic should be discussed in the adaptive management and ecosystem indicators sections.

Page 47-49, Table 4. Several additional " ecosystem elements" should be included for the following ecological attributes. For natural succession processes, include natural flood plains and flood processes, fire, and biotic successional components of most habitat elements (e.g., regeneration of riparian vegetation for multi-layered canopies and sufficient understory coverage should be monitored or restored). For transport of organic materials and organisms, include bay-delta hydraulics, natural floodplains and flood processes, and elements related to dispersal (habitat and corridors) of terrestrial species (e.g., continuous riparian corridor). In Habitat Quality, add inland dune scrub habitat, bay-delta aquatic foodweb, and the productivity and viability of key species dependent on the particular habitat types listed. In Habitat Extent, add inland dune scrub. In the Habitat Connectivity box, include bay-delta hydraulics and the spatial extent and landscape patch dynamics of all habitat (aquatic and terrestrial) elements.

Page 50-76, Types of Ecosystem Elements. This section needs Roman numerals, letters, etc., to help the reader follow the categories. We recommend that Ecosystem Processes (p. 50), Habitat Ecosystem Elements (p. 55), and Species Ecosystem Elements (p.62) be Roman numerals I, II, and III respectively, and everything under them be 1, 2, 3, or A, B, C.

Ecosystem Processes, Page 51-52, Natural Sediment Supply. Nutrient Supply Indicator: Nutrient mass balance models and calculations provide the best estimate of nutrient supply and dynamics. Algal growth rate experiments would determine the limiting nutrient and concentration; this information can be plugged into a nutrient dynamics model.

Page 54, Bay-Delta Hydraulics. The implementation objective should include establishing and maintaining preferred salinity patterns. Salinity patterns should be an ecosystem process with its own implementation objective, endpoints, and success criteria. Only fish indicators are proposed; this is insufficient. The implementation objective is not restricted to fish. Conceptual modeling will likely show other aquatic animals and plants, habitats, and salinity patterns as ecological endpoints.

Page 55, Bay Delta Aquatic Foodwebs. An additional indicator should be target nutrient levels and loadings based on nutrient limitation/threshold research and nutrient mass balance and loading model. Next steps would include conducting nutrient limitation/threshold research and developing a nutrient mass balance and loading model.

Habitat Ecosystem Elements, Page 55, Extent. The document states that the "total quantity of a habitat type can be linked to watershed functions or species population size." However, habitat extent is not necessarily directly related to population size. Clarify what is meant. In addition, to ensure that the "habitat type provides the functions within the landscape that it has historically provided" requires data documenting historic

functions. Discuss the data sources that will be used to establish historic functions. Finally, the examples included in the section emphasize aquatic habitat and fish species. This section should be expanded to address other habitats and other plant and animal species.

Page 56, Quality. Use of the SRA Suitability Index Model alone will not be sufficient to assess the quality of riparian habitats for other riparian-dependent species. A songbird guild model, and other species, should be used since the SRA model only evaluates the quality of the vegetation/aquatic interface and does not look at the riparian corridor in its entirety (i.e., for riparian songbirds, neotropical migrants, etc.). To assess the quality of a habitat, we recommend monitoring of species presence, productivity, and population viability to make a correlation between indices and actual reproductive success and habitat needs.

Pages 57-62, Habitat discussions. The discussions of indicators, data requirements, and next steps for most habitat elements are very general. The Service assumes that CALFED will develop more specific and detailed criteria and strategies for each habitat type. The Service is concerned about the level of organization used in defining habitat types. For example, as noted in previous correspondence, there is a wide variety of types of riparian vegetation. We do not agree that lumping all types together is the best approach. More specific classification of habitat types, based on the hypothesis and conceptual modeling process, may be needed.

Page 61, Riparian/Riverine Aquatic Habitat. In addition to presence of fish and wildlife as a data requirement for Riparian and Riverine Aquatic Habitat, productivity, predation, species composition (percent exotics, percent edge species, percent predators, etc.) should be considered data requirements. Presence of species does not necessarily indicate ecosystem health.

Species Ecosystem Elements, Page 62-63, Introduction. The categories of indicators presented cover only fishery species. These categories are not appropriate for other aquatic species or most terrestrial species. No approach or analysis for terrestrial species is presented. The conceptual model approach is recommended over that outlined in this introductory section.

Reproductive success, in addition to abundance and distribution data, is necessary to assess long term survival of a population.

Page 63, Delta Smelt. Under indicators, provide reference(s) for using 1967-1981 period as target.

Page 64, Splittail. Under indicators, provide reference(s) for using 1967-1983 period as target.

Page 64-67, Implementation Objectives and Indicators. The implementation objectives are silent on the CVPIA and AFRP goal of making all reasonable efforts to at least double the natural production of white sturgeon, green sturgeon, chinook salmon, steelhead trout, striped bass, and American shad in the system. The indicators are silent regarding the CVPIA and AFRP goal, except for the discussion on late fall-run and fall-run chinook salmon which cites the AFRP restoration target. This is an inconsistent approach, and in some cases the indicators appear to be inconsistent with the ERPP, Volume II. AFRP restoration goals for the anadromous fish should be discussed in this section, and include implementation of CVPIA and AFRP restoration measures that have already been identified. The AFRP may have identified data requirements and next steps in the implementation, adaptive management and monitoring plans that are in the process of being developed.

Page 68, Western Spadefoot and California Tiger Salamander. Implementation Objective: The implementation objective in the section does not deal with the western spadefoot toad and California tiger salamander. Replace with the correct implementation objective.

Next Steps: One of the steps identified to protect the western spadefoot toad is to reduce traffic on roads they cross. Include a discussion of the feasibility of this and other actions.

Page 69, Giant Garter Snake and Western Pond Turtle. Indicators: The indicators should be based upon a period for which data is available of state the rational for the period selected.

Data Requirements: Site identification and survey efforts should not be focused solely on seasonal wetlands. Not all seasonal wetlands are appropriate habiatat for giant garter snakes. Appropriate seasonal wetlands are those that contain water during the snakes active period from April to the end of October. Giant garter snakes prefer permanent wetlands. The focus should be expanded to include marshes, ponds, small lakes, and agricultural wetlands such as irrigation and drainage canals.

Next Steps: In the last line, "western spadefoot toad" should be deleted and " giant garter snake and western pond turtle" substituted.

Page 69-70, Swainson's Hawk. CALFED should facilitate developing a strong, scientifically based recovery plan. This plan would give specific recovery objectives and targets, and specify the scientific framework and information needs to achieve these objectives. A logical next step would be to form a recovery team to develop the recovery plan. CDFG should be the CALFED agency coordinating these efforts.

Data requirements go well beyond aerial photography. Aerial photos would help to identify suitable nesting locations, but additional data focusing on reproductive success, the key scientific need, and factors affecting it are needed. Data bases (*e.g.*, California

NDDB) and various written documents would also be very important in gathering current and historical information. Also, there are a number of Swainson's hawk experts who have a vast knowledge of the species and its habitat requirements. These resources should be put to use to obtain data requirements.

Page 70, California Clapper Rail, Indicators. This section identifies the indicator of the health of this species as a similar population dynamics and distribution pattern for the species as existed in the 1960s. The Service recommends that the indicator should be the recovery criteria identified in the approved recovery plan for this species.

Page 71, Greater Sandhill Crane. The ERPP should facilitate developing a strong, scientifically based recovery plan. This plan would give specific recovery objectives and targets, and specify the scientific framework and information needs to achieve these objectives. A logical next step would be to form a recovery team to develop the recovery plan. CDFG should be the CALFED agency coordinating these efforts.

Data requirements go well beyond aerial photographs. A key data requirement is reproductive success and factors influencing it. Data bases (*e.g.*, California NDDB), various written documents, and the knowledge of experts would also be very important in gathering current and historical information.

Page 72, Bank Swallow. Indicators: We do not know what pre-1900 bank swallow population levels or population dynamics were. More meaningful indicators would be 1) the degree to which its distribution matches the species' maximum historic distribution, 2) the degree to which population levels meet or exceed those determined necessary for the species' recovery (e.g. population levels set in CDFG's bank swallow recovery plan), and 3) the degree to which the natural river processes, including most importantly natural bank erosion, are preserved and restored to levels which existed prior to the species' decline.

Data Requirements: Its not clear what this section is proposing (e.g., what type of "survey" is proposed), or how it would help bank swallows. Data requirements are needed which refer back to the Indicators. Therefore, the following data requirements are suggested: 1) distribution and size of bank swallow colonies (note that CDFG is already doing this to a large degree, on the Sacramento River), 2) total bank swallow population size and population trends, especially reproductive success (which should follow from data requirement #1), and 3) the amount of suitable bank swallow nesting habitat, and the patterns at which it is created and lost. Float trips down rivers during swallow nesting season have been used in the past to survey for bank swallows, and could accomplish all of the above, in combination with a GIS system to track habitat dynamics. Aerial photographs would be of secondary value, except perhaps to address data need #3, or to identify new areas for survey/data collection outside of main survey routes (e.g,. on smaller tributaries). If aerial photos are used, they might be most useful if taken when deciduous plants are leafless (not during spring or summer) in order to have best visibility of the steep, actively-eroding banks that are the species' nest habitat.

Next Steps: Many of the listed activities are of marginal benefit, at most, to bank swallows. Programs which are likely to have substantial direct benefit to bank swallows include:

--the Central Valley Project Improvement Act (note correct name of the program),
--the Riparian Habitat Joint Venture,
--Nature Conservancy programs along the Sacramento River, upstream of the Delta,

--the riparian habitat program being planned by the Riparian Habitat Subcommittee of the Upper Sacramento River Advisory Council (SB 1086),
--the Sacramento River National Wildlife Refuge, and
--riparian habitat acquisition and management along the Sacramento River by the CDFG and the Wildlife Conservation Board.

Page 75, Neotropical Migratory Bird Guild. Data requirements go beyond the need for aerial photographs. Expansion of the Institute for Bird Populations' Monitoring Avian Productivity and Survival program should be considered as a data collection tool for the program action area; predation on neotropical songbirds by corvids, brown-headed cowbirds, etc., should also be monitored. Increases in wetland and riparian habitats should include, in addition to increased acreage, increases in suitability for neotropical migrants, such as establishment of buffers between riparian areas and cropland, predator control where necessary, and enhancement of structure necessary for successful nesting.

Focused Research

The ERPP correctly implies that an effective restoration program must start with acquiring knowledge that will provide the scientific and technical basis for restoration actions. The ERPP should systematically and comprehensively determine the necessary scientific information to develop, implement, and evaluate ecosystem restoration and management strategies; assess current scientific information; and identify scientific information gaps and the activities (focused research, modeling, monitoring) to fill these gaps. CALFED should consider conducting workshops or meetings with scientific and technical experts for each ecological zone, and perhaps for special topics such as fisheries, listed species, and contaminants, as one means to accomplish these tasks. CALFED should identify and evaluate all scientific activities by all levels of government, academic and scientific institutions, and stakeholder groups. These efforts would identify scientific needs for focused research, monitoring, and modeling. As the document indicates, the approach to date for focused research (responses from 13 individuals) is not complete.

This section predominantly focuses on aquatic ecosystems. CALFED should develop research goals and activities for terrestrial habitats, ecological processes, and species; riparian dependent species; and non-aquatic special status species (e.g., yellow-billed cuckoos, neotropical migrants). Suggestions include: extent of dispersal habitat for birds, mammals, and herps; avian productivity research.

Important scientific needs relevant to all ERPP elements and subprograms are the influence of natural disturbance relative to human stressors on ecosystem structure and function and the role of natural disturbance on restoration actions. Research objectives and activities regarding these topics should be developed.

Page 77, Focused Research, Introduction. Thirteen of forty-five individuals responded with focused research ideas. Include a summary of the affiliations of the individuals who were asked and of those who responded.

Page 78, Restoration -- Shallow Water/Wetland Development. Add research topic: Evaluate competitive interactions between native plants (SAV and emergents) and invasive exotic plants; effects of exotics on native plant communities.

Page 79, Ecosystem Productivity. Add research topic: Conduct light and nutrient limitation/threshold experiments for phytoplankton and key SAV.

Page 80, Aquatic Resources, Delta Smelt. Add the following research topics: Determine the magnitude of flows necessary to transport larval and juvenile delta smelt to rearing habitat in Suisun Bay.

- Determine the effects on delta smelt population abundance and distribution of adding days of X2 location at 1) Collinsville, 2) Chipps Island, and 3) Roe Island.
- Continue evaluations of screening criteria to protect various life stages of delta smelt from diversions.

Page 82, Introduced Species. The Service assumes that CALFED has or is developing focused research questions and activities for invasive introduced/exotic plants, even though none are specifically mentioned in this section. Add research topics on the effects of invasive exotic plants on ecosystem processes, plant communities (e.g., competitive displacement), and animals (e.g., effects of altered habitat).

Appendices

APPENDIX 2 (TABLES A1-A3).

These tables are difficult to follow and understand. Conceptual models will better show the linkages among stressors and their effects on ecosystem function and structure (processes, habitats, species). Many of the stated "influences" are subject to interpretation, some are incorrect. The headings "Other Aquatic Species, Terrestrial Species, and Plant Species" in Table A3 are too general and confusing; therefore, they do

not have much meaning. For example, plants are aquatic and terrestrial species, yet for many ecosystem elements (e.g., all wetland habitats) the stated influence on Plant Species differs from the stated influence on Aquatic Species; same for Plant Species and Terrestrial Species (e.g., Dune scrub, perennial grasslands). We recommend using conceptual models and deleting these tables. The conceptual models should be presented at the beginning of each volume with a written description of the conceptual framework and goals, objectives, and purposes of the ERPP.

APPENDIX 3.

In appendix 3, in general, the solid black is not defined in the key.

Page 97, Appendix 3, Programmatic Actions Related to Central Valley Streamflow and Water Acquisition. The Service concurs with the discussion indicating that water acquisition is coequal to land acquisition. However, the tables for phased implementation of land acquisition on pages 101 and 102, do not reflect the same priorities and level of effort as for water acquisition on page 97. The land acquisition should receive a high level of effort through the first 15 years, and probably the entire 25 years.

Page 99, Programmatic Actions Related to Improving Bay-Delta Hydraulics. Improving Bay-Delta hydraulics is one of the most important CALFED elements. It should receive a high level of effort through the first 15 years, and probably the entire 25 years. The fact that planning and modeling studies and pilot implementation projects will be required accentuates the need for high priority and level of effort.

Page 99, Programmatic Actions Related to Improving Bay-Delta Aquatic Foodwebs. This should receive at least medium level of effort in years 1-15. This should not be a low priority because additional scientific information is needed. One could effectively argue that subprograms requiring additional scientific information should be high priority.

Page 100, Programmatic Actions Related to Riparian and Riverine Aquatic Habitats. Text states high priority for riparian restoration in years 1-5, but graphic indicates medium. We believe that riparian restoration should be a high priority in years 1-5. Furthermore, restoring stream meander corridors (page 98) is consistent with and will contribute to restoring riparian habitat. The Service recommends that riparian restoration should be given a high level of effort in the first 10 years, as well as the second 10 years.

Page 101, Programmatic Actions Related to Converting Land to Habitat for Aquatic Species. Aquatic species include more than just fish. CALFED must take an ecosystem approach to this program. Although the document states in the introduction that an ecosystem approach will be employed, too often the proposed implementation strategies take a species management approach, not an ecosystem approach. Freshwater and seasonal wetland habitats and nontidal perennial aquatic habitat must be included here.